Toward a Model of Cognitive Process in Cartoon Comprehension

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The comprehension of humorous material involves an important interaction between use of general world knowledge and the encoding of new verbal or pictorial information. Understanding humorous episodes often requires the comprehender to draw a number of inferences about the characters and events in the episode. Unlike comprehension of other types of material, however, these inferences often are not straightforward nor applied "automatically." Instead, a logical series of inferences may be required, implying a form of problem solving activity. This characterization of comprehension of humorous material is particularly appropriate for multiple frame cartoons. Since we are especially interested in the role of these sorts of cognitive processes in understanding humorous material, we have focused our efforts on cartoon comprehension.

The process model that we have been trying to develop is based on recent conceptualizations of comprehension processes and on theoretical ideas about the defining attributes of humorous material. We characterize a cartoon as a brief narrative that is described pictorially and linguistically. As such, much of the information learned from reading a cartoon is inferred rather than explicitly stated or illustrated. It is further assumed that as a cartoon is processed expectations about upcoming information are constructed, just as in reading ordinary discourse. Often these expectations are violated by some form of incongruous information, causing a revision of previously inferred information or at least a reorganization of knowledge about the event being described. This revision or resolution of incongruity has been claimed to be an important element of humor by recent theorists. In addition, resolution may introduce further incongruities which are never resolved. We argue that these inferential problem solving processes are of central importance in any account of comprehension or appreciation of humorous material.

In order to specify in more detail the nature of comprehension processes associated with reading cartoon material, we made use of multiple regression modelling procedures. We planned to focus on cognitive processes involved in cartoon comprehension and, to a lesser extent, on the characteristics of cartoons that are associated with humor. Therefore, we sought to develop regression models that would account for variability of cartoon items on three dimensions: (a) comprehension time, (b) problem solving processes associated with understanding the joke on which a cartoon is based, and (c) degree of humor.

We selected a set of 64 cartoons sampled from five different syndicated cartoon strips. The items were originally published between 1976 and 1978. A sample of 35 university students rated (on a 7-point scale) the degree of difficulty involved in understanding or figuring out the joke on which each cartoon was based. This served as a very general measure of the complexity of the problem solving comprehension processes we have postulated. Another sample of 56 students was shown the same items in the following manner. First, all frames of a cartoon except the last frame were shown together, then the last frame was shown. Time required to comprehend each section (first frames and last frames) was measured. In addition, these subjects rated on a 7-point scale the degree of humor of each cartoon.

Cartoons were then classified according to a set of independent variables representing many characteristics of cartoon items. Verbal information variables included number of letters, syllables, words, propositions, and sentences and number of speaker transitions. Visual information was coded by such variables as number of characters, number of physically transformed characters, change of scenes, activity, and presence of a visual detail which was critical for understanding a cartoon. Cartoons were also coded according to whether a possible or impossible incongruity was introduced in the last frame and left unresolved. The logic on which a cartoon was based was also coded. Categories included exaggeration, iteration (e.g., a tow truck towing a tow truck), and model theory (the reader interprets an ambiguous statement or situation in the most usual way, then finds that an alternative interpretation was intended). Finally, in order to reflect cartoonists' style differences, the items were classified according to cartoon strips.

Four regression analyses will be reported. In all cases a stepwise multiple regression was used in which variables were added into the regression equation until an optimal adjusted R^2 was reached. The first two analyses involved mean comprehension time on first frames and on final frames. The list of independent variables included those mentioned above as well as mean rated humor and difficulty in understanding the cartoon's joke. We had two general expectations about these analyses. First we expected to do a better job of accounting for variability in first frame comprehension times since most of the complex comprehension processes are associated with the last frame. For similar reasons we expected the last frame comprehension time regression equation to more heavily weight the difficulty rating variable than would the equation for first frames.

The optimal adjusted R^2 for the first frame analysis was a very respectable .94 (multiple R=.98). Eighteen variables were entered although six did not contribute significant predictive power. Comprehension time increased as a function of number of letters, sentences, and transformed characters in the first frames. In addition, relatively small contributions were made by difficulty rating (smallest beta weight of all significant variables) and the variable which coded exaggeration: longer comprehension times were associated with higher difficulty and cartoons based on exaggeration. The seven other significant variables were all supressor variables: very low simple correlations with comprehension time, but they accounted for some variability of significant predictor variables which was not associated with comprehension time. Most of these suppressor variables were associated with verbal and visual information contained in the last frame.

The regression analysis of first frame comprehension time successfully accounted for a great majority of variability. Material of this sort does not normally call for much complex cognitive activity while reading the first frames, and so a few simple variables are sufficient to account for most of the variance. Number of letters and transformed characters together produced a regression equation with an adjusted R^2 of .86. Rated difficulty did not play a large role in accounting for first frame comprehension time. Finally, it was rather surprising that other visual information variables such as number of characters did not have much impact. It appears that as long as characters maintain a consistent appearance readers require very little time or effort to recognize them, even when first introduced.

The regression analysis of final frame comprehension time produced an optimal adjusted R^2 of .79 (multiple R .91), with 13 independent variables involved in the equation. Only five variables made significant contributions. Comprehension time increased with higher numbers of letters in the last frame, rated difficulty, number of new characters introduced in the final frame, and number of syllables in the first frames. Number of syllables

in the last frame was a supressor variable. As expected, the importance of problem solving comprehension processes was evident in the analysis. Rated difficulty was the second variable entered into the equation for last frame comprehension time. In addition, the introduction of new characters in the last frame requried more reading time. Reinterpreting information from the first frames, or using that information to understand the last frame are important processes since amount of first frame verbal information strongly influenced last frame comprehension time.

Since difficulty ratings played such an important role in the comprehension time analyses, it would be interesting to discover which variables contribute to the degree of difficulty in comprehending a cartoon. The relevant regression analysis indicated that the present data could offer only limited aid in answering this question. The optional adjusted R^2 was only .52 (multiple R = .85), with 26 variables in the equation. Thirteen of the variables made significant contributions. Cartoonists' style played an important role as the first variable entered was the "0/1" variable which coded cartoons as being from "Wizard of Id" versus some other cartoon strip. According to the regression model, such cartoons added a full 1.5 units of difficulty on the 7-point scale. Cartoons based on iterative logic also increased difficulty. Increases in the number of propositions, syllables, or speaker transitions in the first frames also increased difficulty ratings. The other seven variables (other cartoons and last frame information) acted as suppressor variables. This analysis clearly points to the importance of reviewing first frame information while trying to comprehend the final frame and basic joke of a cartoon. Difficulty was not associated with amount of final frame information which, in itself, is just as straightforward as verbal and visual information contained in the first frames. Interpreting the last frame in the context of previous information, however, is a major part of the reader's problem solving comprehension process.

Finally, what makes cartoons funny? The regression analysis of humor ratings produced a rather low adjusted R^2 of .60 (multiple R = .82), so no definite answers are yet available. Nine significant variables were involved, two of which are related to cartoonists' style. The "Wizard of Id" and "Hagar the Horrible" were associated with rather high humor ratings. These ratings also increased with the number of scene changes in the first frames and the number of speaker transitions in the last frame. Adding an impossible incongruity in the last frame seemed to improve the humor of cartoons, but basing a cartoon on a critical visual detail in the final frame was associated with reduced humor ratings. The other three variables were suppressor variables. Obviously this analysis does not provide a very satisfactory explanation of what makes a cartoon humorous, but it has helped to identify attributes that characterize successful attempts to create humorous materials.

Our future efforts will be directed at a closer and more detailed study of the problem solving comprehension processes involved in reading cartoons. In addition, it is clear that it will be a difficult task to identify the nature of the relationship between humor and these cognitive processes. In our data there is presently no clear relation (linear, or otherwise) between humor and difficulty ratings. Although we have begun to make progress in the development of a model of cartoon comprehension processes, the secret of the humor of cartoons is still well kept.